Masdar City – CO_2 free living in the desert?

Thomas Marshall
André Müller

1 The city as a project

Masdar City closes every day at 17.00 h – welcome to a gated and wirelessly connected community of some workers and a few (student) residents next to Abu Dhabi International Airport, staircases will guide you to the second floor where you may find the city! What sounds like a staircase wit, is reality.

The city is a project[1] and it is managed as such: "Masdar is a new kind of energy company that takes a holistic approach to renewable energy and clean technology. A commercial enterprise, Masdar operates through five integrated units, including an independent graduate research university, and seeks to become a leader in making renewable energy a real, viable business and Abu Dhabi a global centre of excellence in the renewable energy and clean technology category" (Masdar City 2011a: 17). The project is entirely state-owned by the Mubadala Development Company[2] and constitutes one of the ten pillars of this enterprise[3]. Masdar – which holds Masdar City – is part of its energy sector's assets. Mubadala, in Arabic, means change – what a choice for a name!

The project and the city as such were set up as a special economic zone in the Emirate of Abu Dhabi.[4] This underlines its character as a commercial product rather than a city in its traditional meaning. This entrepreneurial context offers for those intending to become part of the project a "quick and easy set-up with (a) one-stop shop for registration, government relations and visa processing, 100% foreign ownership, zero percent import tariffs, zero percent taxes on companies and individuals, no restrictions on capital movements or profits" (Masdar City 2011a: 31).

Change stands in a country like the United Arab Emirates (UAE), a federation of seven emirates of which the Emirate of Abu Dhabi can be considered as primus inter pares, as a new perspective in further development. The idea of setting future priorities in education rather than exploiting obviously limited oil resources has gained power in the Middle East Region. In that respect, the Qatar Foundation for Education, Science and Community Development initiated in 2009 the World Innovation Summit for Education (WISE) (cf. Qatar Foundation for Education, Science and Community Development), intending to influence the regional mind setting of diversifying economic activities and thus creating varied pillars of societal development.

Aerial view of Masdar City

The walled Masdar City overarched by cranes

Photos: T. Marshall/A. Müller 2011

Building a city as a project definitely requires technical approaches and solutions, especially when a so called CO_2 free city is to be implemented. Yet, a city is supposed to be more than the composition of technical elements. It is the social aspect that very much determines a city to be the physical place where people live and interact with each other. But, where is the human aspect in this technocratic and entrepreneurial world of Masdar City – a desert outskirt part of the city of Abu Dhabi?

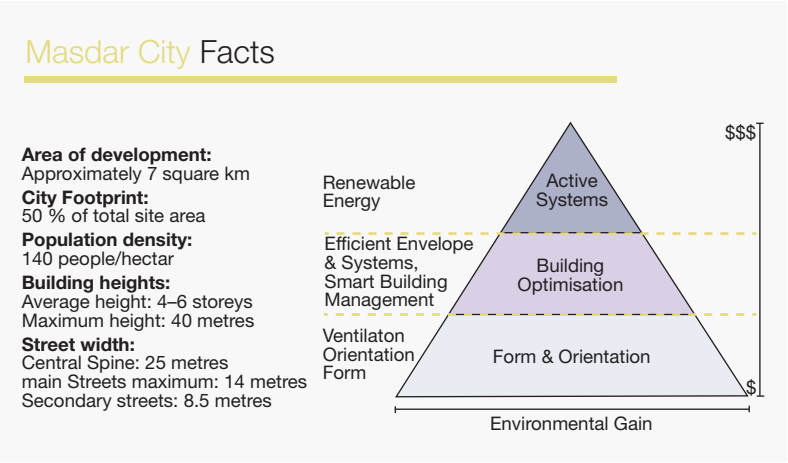
Thomas Marshall
E-Mail:
thomas.marshall@gmx.com

André Müller
Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR)
im Bundesamt für Bauwesen und Raumordnung
Deichmanns Aue 31–37
53179 Bonn
E-Mail:
andre.mueller@bbr.bund.de

"Masdarians" gathering at the main square

Photo: T. Marshall/A. Müller 2011

Figure 1
Masdar City Facts



Source: Masdar City 2011

2 Masdar City as part of a broader (inter)national context

To understand the establishment of Masdar City as a long-term investment project for Abu Dhabi, it is interesting to contextualise it in decision-takers' plans. This will allow for a better understanding of the origins and aspirations of this project. These plans, both established around the mid-2000's and running until 2030, follow Sheikh Zayed bin Sultan Al Nahyan's vision "for Abu Dhabi to continue to create a confident, secure society and to build a sustainable, open and globally competitive economy" (UPC n.d.).

These plans however were established during a particularly prosperous period for the region, notably through its real estate market. Superlative projects such as The World or Burj Khalifa in the neighbouring Emirate of Dubai were showcase models of this economic success and sought to confirm the UAE's "being on the map". The financial crisis which started in 2007 hit particularly hard development and building projects, bringing many to a halt. The ambitions presented in these documents must therefore be taken as having been established in a specifically optimistic and confident vision of the future.

Abu Dhabi Economic Vision 2030

Abu Dhabi grew to become the modern city it is today through the "kick-start" impulse given by the discovery of oil and its subsequent exploitation in the 1960s. When the Abu Dhabi Economic Vision for 2030 was drafted in 2005, the oil industry represented approximately 60 % of the national GDP. This figure is expected to be almost halved, down to 36 % by 2030.

This ambition is to be achieved through a substantial diversification of economic activities in Abu Dhabi in a context of continuous economic development. This diversification will ensure the emirate's economic foundations, making its economy more durable as less reliant on the finite extraction of oil. Furthermore, plans for developing Abu Dhabi's sustainable economic foundations will also include a balanced social and regional development, ensuring a spread-out distribution of wealth.

To this extent, sustainability in an economic understanding is the strive to ensure durability in the structure and positioning of economic activities. This goal has been established knowing that the formidable economic input which has been oil is not meant to last and that its impact on the economic structure of the emirate is also the source of an imbalance and therefore associated volatility and insecurity.

In establishing its economic vision for 2030, it is interesting to note that the authors of the plan took into account other countries to which Abu Dhabi should not only be compared to, but even "benchmarked" (The Government of Abu Dhabi 2008: 9). These countries include Norway which has put into good use a comparable oil and gas output to diversify its economy, Ireland for the development of a knowledge-based

economy, New-Zealand as it has come to rely on a relatively large export base and Singapore as a successful example of a transformation economy. Such comparisons are good hints to the aspirations of Abu Dhabi's political and economic leaders.

Masdar City is supposed to be a pillar of the Abu Dhabi Economic Vision 2030 (cf. Masdar City 2011a). In Arabic, "masdar" means source or root which may be interpreted as a source for new techniques in renewable engineering, a new city rooting or simply the water source that we are familiar with when thinking of an oasis in the desert ...?

Abu Dhabi 2030 Urban Structure Framework Plan

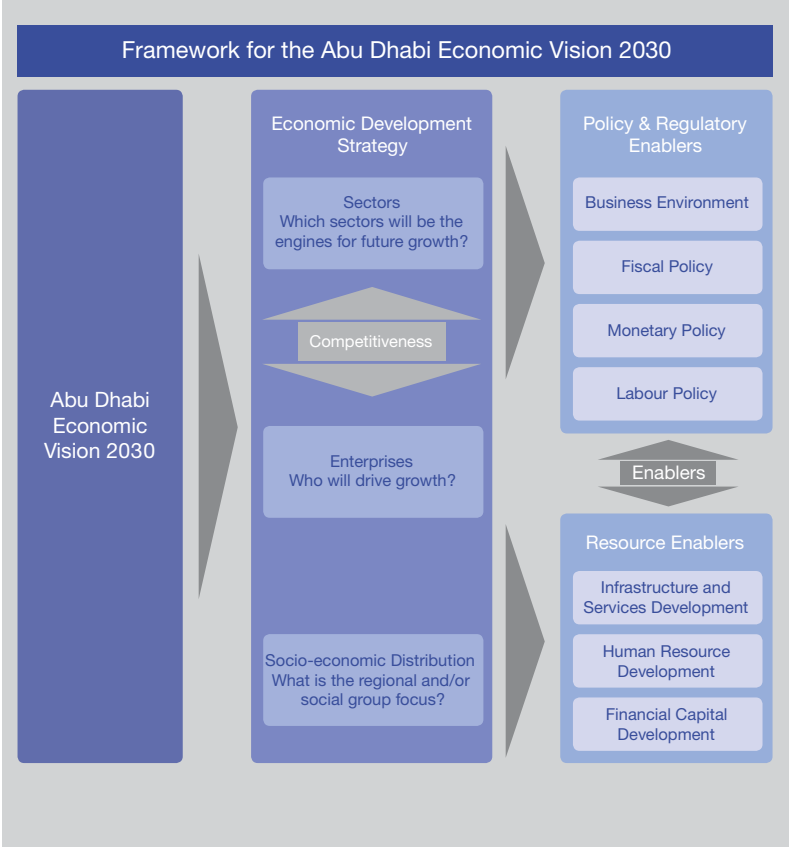
The Abu Dhabi 2030 Urban Structure Framework Plan is the second main public policy document produced by the government of Abu Dhabi in recent years. It provides an overview of the urban structure and a development pattern in accordance to forthcoming economic and social evolutions. It also provides an institutional and regulatory framework.

The notion of "sustainability" induced in this document is overall much different to that given by the Economic Vision and leans more to the environmental connotation generally assumed. For example, an overarching theme in this document is the reduction of the importance of automobile share in future urban developments. This issue is addressed not only in terms of precise planning operations (developing public transport system, fostering densification of existing urban forms, etc), but also as a general trend to move towards.

However, several outstanding key points in this document might challenge the notion of sustainability beyond its environmental aspect. The Plan Abu Dhabi 2030 document introduces for example the need for specifically emirati neighbourhoods. Emirati nationals represent today only approximately 20% of the total population in Abu Dhabi, the rest consisting mainly of working immigrants from the Indian sub-continent and South-East Asia. The total population is expected to rise threefold in the coming years, reaching 3 million or more by 2030.

Aware of their statistical inferiority whilst at the same time having recently developed a national sentiment since the establishment of Abu Dhabi as leader of the integration of fellow emirates into the creation of the UAE as a country, Emiratis have sought to defend and nurture their cultural heritage. This is for example the case in the plans for the monumental and iconic Zayed National Museum to be developed in Saadiyat Island (cf. below) which will be dedicated to the different aspects of heritage and culture in the UAE, as well as to Sheikh Zayed bin Sultan Al Nahyan (1918–2004), the "father of the nation". Cultural heritage and traditions are also sought to be protected in the creation of specific Emirati neighbourhoods, whose design should correspond to traditional national lifestyles. This includes sufficient space in order as to develop traditional housing allowing for multi-family and family-guest-related architecture, as well as taking into account the traditional neighbourhood structure organised around a common public space, mosque, local services and facilities.

Figure 2
Framework for the Abu Dhabi Economic Vision 2030



Source: The Government of Abu Dhabi, 2008

The Abu Dhabi 2030 Urban Structure Framework Plan overall expresses an acute awareness of the multiple changes and challenges which the Emirate will face in the coming decades. Confronted to the reality that the urban structure and shape will be heavily affected by – and should hence foresee adaptation to – profound future economic and social changes, it seems as if Abu Dhabi in its planning strategy is concerned by the notion of conservation and protection at multiple levels. This can be observed not only in the case of conserving traditional cultural and housing lifestyles in the face of demographic and social evolution, but also in the importance given to environmental protection. To a certain extent, developing a "sustainable economy" is also a way of ensuring Abu Dhabi's future viability.

The economic vision and urban plan for 2030 reflect the strategic decision taken in regards to oil resource and income management. By heavily subsidising structural change at economic and urban level, the Abu Dhabi Government has chosen to use the current wealth to generate diversification. Another approach to this natural resource management was to create restrict oil income in order to not only spread its exploitation over time but also to foster creativity and a need for alternative revenue.

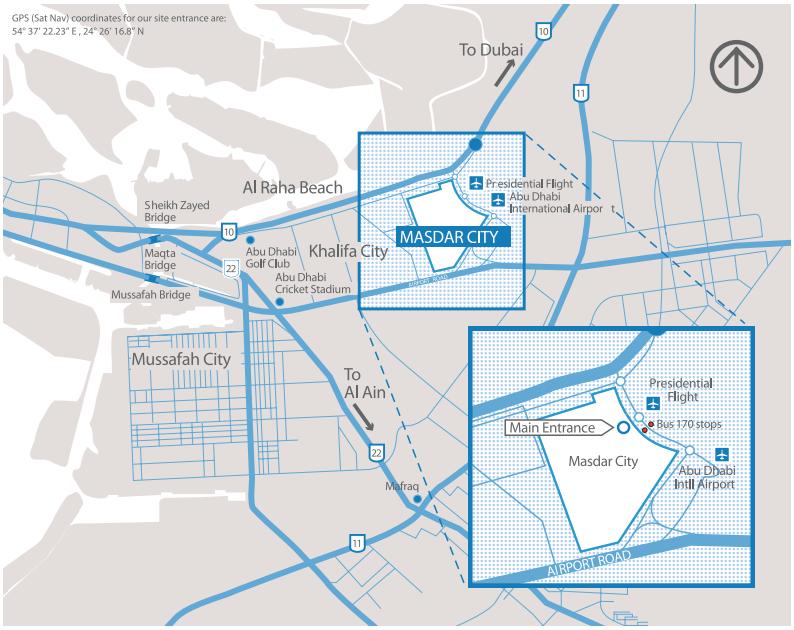
3 Masdar City and its (CO_2 free) functioning

Visitors may observe Masdar City as a tourist attraction. Not only business tourists are regularly guided through the city, but some beach tourists had also been spotted there. The official marketing machinery is offering guided tours and has launched TV spots. It is even the makers of Masdar City who seem overwhelmed by the Disneyland effect provoked: "The result, Mr. Foster, acknowledged, feels a bit like Disneyland. 'Disneyland is attractive because all the service is below ground', he said. 'We do the same here – it is literally a walled city. Traditional cars are stopped at the edges" (Ouroussoff 2010a: 2).

Nonetheless, its technical character makes the net community set it in the neighbourhood of specialised new towns: "Masdar City will be the latest of a small number of highly planned, specialized research and technology-intensive municipalities that incorporate a living environment, similar to Novosibirsk, Russia, or Tsukuba Science City, Japan" (Wikipedia). Others are simply fascinated by its visionary approach (cf. Krings 2012).

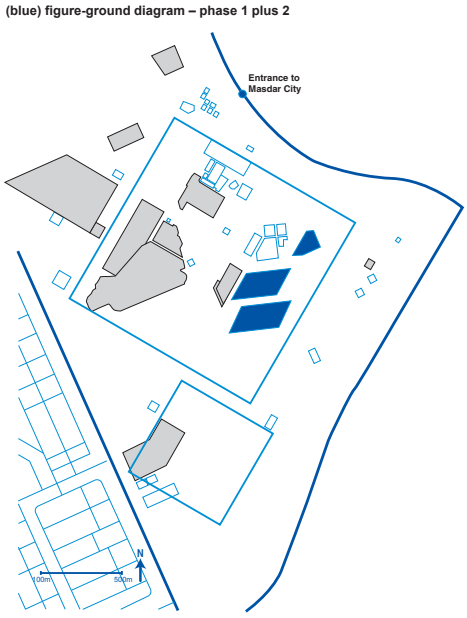
The guide leads you through the city following a tour of some twenty stations that in total would help explain the (technical)

Figure 3
Directions map



Source: Masdar City 2011

Figure 4
Tour map



Source: Masdar City 2011

functioning of Masdar City. Every single element of this tour is dedicated to support developing the city as CO_2 free. The urban fabric is officially seen as: "(...) optimally oriented, integrated, low rise – high density, (a) vibrant urban realm, pedestrian friendly and (offering) high quality of life (and) convenient public transportation, (referring to) traditional Arabian city design (as well as respecting an) environmental pyramid (...)." (Masdar City 2011b: 3 f.)

Masdar Headquarters

Part of the Masdar City Master Plan is a building lot foreseen for Masdar Headquarters, a building project already designed by Adrian Smith + Gordon Gill Architecture as "the world's first large-scale positive-energy building" (ibid: 25), which is supposed to host in the future the secretariat of the International Renewable Energy Agency (IRENA) – the intergovernmental organisation dedicated to promoting renewable energy. One would anticipate that, due to the subsequent short distances, IRENA may become the political wing of Masdar. This seems obvious in the strive for changing the behaviour of people living in the region, according to IRENA terminology the MENA (Middle East and North Africa) Region, where still a group of small countries (e.g. Qatar, Bahrain) shows top amounts of CO_2 emissions per capita due to their energy-intensive industries (cf. The Guardian 2011).

Masdar Institute of Science and Technology

The Masdar Institute of Science and Technology (MIST) is an academic institute offering master programmes and courses that focus on technical subjects, such as water and environmental engineering, microsystems engineering, mechanical engineering, materials science and engineering, computing and information science, engineering systems and management, electrical power engineering as well as chemical engineering. One is looking desperately on the institute's website for subjects like behavioural science. Locals holding the UAE citizenship can apply for scholarships – free of charge.

Producing renewable energies

One of the most eye-catching features of the actual site is the solar panel test field where more than 35 different types of panels are being tested, including those to be mounted on the different MIST buildings. Selection criteria respond to the energy demand as well as the reliability of panels in conditions of continuous desert operation. Turning the conventional pyramid of concentrating solar power by mirrors upside down is the object of the beam down project with which sunlight is converted into electricity by eliminating energy losses resulting from bringing the heat-transfer fluid to a receiver at the top. "It is estimated that the project would generate 75–85 MWh per annum" (Masdar City 2011b: 7).

As the aquifers below Masdar City offer water temperatures between 85° and 105° C well-drillings had been made to about 2 500 metres to draw hot water and re-inject it after heat extraction in a geothermal test site.

In addition, a 10 MW solar power plant farm has been built targeting the production of 17,5 MWh per year and thus avoiding the annual equivalent of 15 000 tons of carbon emissions. The infrastructure of this farm is entirely made of recycled material and low-carbon concrete using ground granulated blast-furnace slag. The core site of Masdar City in terms of building construction is the material recycling centre where, on a site of 12 hectare, concrete, wood, metal, plastic and other material are made available in divided fractions for contractors or sent off-site for recycling somewhere else. Excavated sand is stockpiled for reuse in contrast to the conventional custom in the UAE to just trucking it away from the building site.

Working underground

Masdar is a second floor level city and is built on a podium seven metres above ground level. This has been done to accommodate the fancy public transport system (cf. below) and allow the city to develop on a pattern of pedestrian-friendly narrow streets. The heart of this podium, the so-called utility trench or undercroft, serves as a citywide level offering easy access to the city's complex utility infrastructure, including power and sewage lines, multiple pipes for potable, grey and black water, wires for Masdar's information and communication system as well as waste and recycling networks. Apart from that, the undercroft hosts the MIST's technical laboratories. Magnets have been embedded in the undercroft's concrete floor every four metres assisting

the public transport system navigate. Overhead, an antenna runs the length of the undercroft providing wireless link between the public transport system and the system computing.

Providing sustainable public transport

Masdar's public transport system has been designed as personal rapid transit (PRT) system; a system based on small, comfortable, air-conditioned and driverless vehicles running on magnetic corridors at a speed of up to 40 kph on straightaways and 25 kph on curves. The vehicles are equipped with onboard sensors detecting any obstacles in their path, medical assistance and emergency stops and are powered by batteries which can be recharged while standing in one of the four berths at each PRT station. The PRT stations are constructed of prefabricated waffled-concrete panels as well as backlit recycled glass walls. Light tubes, muffled with highly reflective recycled steel layers, assist illuminating the stations with natural day light. At the entrance to MIST a spiral staircase leads upwards to the university reception level. Elevators, intended only for those unable to use the stairs, are located out of view beyond the staircase. "With walking encouraged to reduce energy use in Masdar City, stairs are always prominently featured, while elevators are hidden – the reverse of conventional buildings, where stairs are often hard to find" (ibid: 14). A parking garage at the entrance to Masdar City offers car drivers parking lots for their cars and shall convince them to use the PRT.

Masdar City is part of the public transport system of Abu Dhabi: the bus no. 163 links it to the city centre, running every hour and calling at the Petrolium Institute (sic!). The PRT system is currently functioning, though system breaks seem to be a recurrent struggle for those working at MIST. An unknown MIST teacher on 12 December 2012 while visiting Masdar: "The public transport system does not work at all – I should not tell you that. I am working here."

Combining traditional urban fabrics with renewable architecture

Based on a master plan designed by Foster + Partners, Masdar City is built around a wind tower. This tower, rising 45 metres above the podium, is the modern interpretation of a traditional architectural feature of Islamic cities and building. Here, the wind tower is composed of recycled steel and anchored in low-carbon concrete in contrast to the clay-brick version of its ancestors. "The tower's height means it can capture upper-level winds and direct them to the open-air public space at its base. Sensors at the top of the steel structure operate high-level louvers to open in the direction of prevailing winds and to close in other directions to divert wind down the tower. A (...) membrane carries the wind downward, while mist generators at the top will add additional cooling to the air. Combinations of evaporative cooling and air movement techniques help to moderate perceived air temperatures, thereby improving personal comfort" (Masdar City 2011b: 16) The tower is used by MIST for diverse scientific experiments.

Streets have an inverted V shape, building facades are stepping out as well as their façade panels do overhang and wind gates help control a wind flow through the city. In

Personal Rapid Transit (PRT)

Source: Masdar City 2011

Personal Rapid Transit (PRT)

Photo: T. Marshall/A. Müller 2011

cooler months, building doors remain open to give way to open air while in warmer months doors are kept closed to provide and air-conditioned passage. All architectural features in Masdar City are meant to providing an utmost amount of shadow and to keep air flowing through the streets.

The predominant colour of Masdar is red – referring to the colour of desert sand. At present, all residential buildings facades are composed of red sand-coloured, undulating glass-reinforced concrete screens which look like and serve the purpose of the traditional Arabic mashrabiya, a screen, traditionally consisting of wood, providing shade from the sun, thus preventing solar gain on the building walls as well as allow residents to look out the street while maintaining their privacy. In addition, they permit air to pass through and thus cooling the balconies.

Another prevailing colour is the one of recycled steel. Laboratory buildings are covered façade-wise with air-filled cushions ensuring almost no solar gain on the building structures and thus limiting the heat re-radiated to the streets. A reflective foil-clad inner layer behind these cushions directs light to the streets below. Vertical (to block morning and afternoon sun) and horizontal (to block midday sun) louvers set on top of windows prevent sunlight from shining into the buildings. "Aside from the windows, the rest of the façade is again highly sealed and insulated, and wrapped in 90 % recycled aluminium sheeting in the same rose-red colour as the (...) screens. The aluminium sheeting used on the residential building has 6,7 kg of embedded carbon per square metre of 2 mm-thick sheeting compared to conventional aluminium sheeting, which has 56 kg of embedded carbon per square metre" (ibid: 18).

Residential buildings are naturally ventilated: "During the evening, cool air flows

Figure 5
The first phase of Masdar City

Source: Masdar City 2011

Wind tower – alley view
Photo: T. Marshall/A. Müller 2011

Wind tower – interior detail
Source: Masdar City 2011

Mashrabiya
Photo: T. Marshall/A. Müller 2011

Roof detail of "Knowledge Centre"

MIST info screen

Photos: T. Marshall/A. Müller 2011

from openings on the podium level, cooling the interior walls and flowing out through open louvers at the top of the buildings. In warm weather, these openings are closed during the day to keep cool air in, while the thermal cooling of the walls keeps the interior hallways pleasant" (Masdar City, 2011b: 20). Laboratory buildings are generally open-plan and column-free to facilitate integrated and cross-disciplinary study and research programmes. "All services, such as power, data, gasses and ventilation, are located in the overhead service carriers, thereby enabling plug-and-play access anywhere on the floor" (ibid: 19). Waste separation (e.g. by fractions of glass, aluminium, plastic, paper) is highly appreciated and its use reinforced by placing bins inside residential and laboratory buildings as well as in street corners.

The central MIST building for communication purposes is the "Knowledge Centre" putting forward the architect's efforts to optimise the photovoltaic energy harvesting of the building. A large self-shading overhang is the allowed building the building's front part entirely in glass. "Although the glulam (glued laminated) timber roof is graceful and beautiful, the reason it was chosen over steel was because of using FSC- and PEFC-certifies timber as it has a lower embodied energy coefficient. On the northeast section of he building's exterior roof, the eye-catching flat and folded zinc cladding provides ventilated shading to parts of the building (...). The 150 tons of Douglas fir timber used in the ceiling were sourced in equal amounts from Forest Stewardship Council (FSC) certified forests and from Programme for the Endorsement of Forest Certification (PEFC) certified forests, which means the wood came from sustainably managed forests and was provided by timber merchants with 'chain of custody' certification from one of these two organisations. Zinc was chosen as the material for the roof cladding because it had the lowest overall environmental footprint" (ibid: 22).

The energy efficiency of the entire city is indicated and published daily on screens in public spaces of Masdar as well as student facilities and their energy consumptions are monitored.

Providing sustainable building material

Apart from integrating the material recycling centre into building processes, a batching plant producing ready-mix concrete was built up. "Tested for strength and durability, even in Abu Dhabi's extreme climate, this concrete is more economical and has higher strength than conventional alternatives, as well as a lifespan exceeding 75 years" (ibid: 26). By using fly ash from coal combustion and blast furnace slag from iron production as additive ingredients, greenhouse gases and air pollution has been decreased. Reconstituted stone is employed too, e.g. in forming pavement features.

Airing and greening the desert

Masdar City is oriented towards the prevailing wind direction, i.e. 38 degrees coun-

ter-clockwise to the north axis. This orientation had been chosen to enhance air moving through streets and parks. Once having been built, linear green spaces will traverse the city and thus channel prevailing winds into Masdar while offering leisure spaces for residents and workers. "In order to reduce water demand for irrigation, plants and trees used in Masdar City are selected from indigenous species, as well as non-native plants that are suited to a hot and dry climate" (ibid: 23). The point is that without intensive artificial gardening mechanisms, this part of the world would never blossom. The desert has been for centuries a place where everything and everyone is struggling to survive.

Cleaning the city

A membrane bioreactor treats wastewater at Masdar City, relying on a capacity of 1500 cubic metres per day. (cf. Masdar City 2011). This solution had been taken to correspond to the hot climate of the area as well as make use of its modular characteristics. These avoid building excessive infrastructure and allow integrating latest technologies once the city will have been enlarged and thus possibly increased its demand for respective treatment facilities.

Creating open-air research facilities

Corresponding to the experimental philosophy of MIST, an open-air research facility had been installed. Students as well as researchers can experiment and test here under real climate conditions.

Giving space to pilot projects

A set of pilot projects is gathered around the city, often constituting cooperation projects with private enterprises.

Extending the city

Next to Masdar City One is situated Masdar City Two. A series of new laboratory and residential buildings as well as recreation facilities, including an open-air swimming pool and a multipurpose conference and concert hall is currently being built. "As with Masdar Intitute, phase I, these building also will be built to a 100-year structural design life" (Masdar City, 2011b: 24). And what comes after these 100 years?

Recycling Centre

Recycled building material

Small-scale recycling unit

Greening the area – artificially
Photos: T. Marshall/A. Müller 2011

A little further south-eastwards, Masdar Headquarters are planned to be built one day: "The building's rooftop PV array is expected to generate 5,5 GWh of renewable energy annually. The PV panels also serve as shading for the roof, while various building-integrated PV panels further contribute to the renewable energy supply of the building. The building's 11 wind cones provide natural ventilation and cooling (drawing warm air up to roof level, where wind moves it away) and form oasis-like interior courtyards at ground level. The cones maximise diffused natural daylight throughout the building, leading to an anticipated energy savings of approximately 3,5 %. The structure's high performance 'sawtooth' façade allows access to daylight and views while mitigation glare and solar heat gain. This results in a lower cooling load and increased energy generation. When installed, the 15 590 photovoltaic panels on the roof of the Masdar Headquarters will form one of the largest roof-mounted integrated PV panel arrays in the world and displace approximately 4 400 metric tones of CO_2 equivalent a year" (ibid: 25).

Gating the community

Masdar City is perceived as a gated community, mainly for workers and a few students. Teaching or administrative MIST personnel does not seem to live there. Some authors (cf. Ouroussoff 2010a: 2), underline that phenomenon: "But the design also reflects the gated-community mentality that has been spreading like a cancer around the globe for decades. Its utopian purity, and its isolation from the life of the real city next door, are grounded in the belief – accepted by most people today, it seems – that the only way to create a truly harmonious community, green or otherwise, is to cut it off from the world at large."

Mistaking traditional urban fabrics

Planners of Masdar City link their thinking of the urban fabric and architectural design to traditional Arabian city design: "The city's master planners took inspiration from traditional Arabian city planning. Not only does this indigenous design incorporate numerous strategies to address the desert climate, but is also is characterised by relatively low overall energy consumption. That's because traditional Arabian cities are compact and densely populated. They are also socially diverse places where people live and work in the same environs, and feature lively and enjoyable public spaces" (Masdar City 2011b: 4). This statement is partly misleading, as Arabian cities – or better its Islamic buildings – had traditionally been organised according to cultural constraints (e.g. introverted attitude, separation between men and women, family and guests or visitors) rather than responding to climate conditions (cf. Sack 1989).

Supporting global networking

Masdar City is supporting, amongst others, the global networking of different grassroots organisations, such as 350.org. Respective marks are placed on the pathways of the Masdar City Administration. Yet, another marketing gag?

Saadiyat Island

Another major urban project in Abu Dhabi is currently being developed (yet on hold) on Saadiyat Island. This 27 km² island in the immediate vicinity of Abu Dhabi city has been chosen as the site for a mixed residential, leisure, cultural and commercial project. Divided into several specialised districts, it is intended to become a beacon of the emirate's residential, leisure and commercial activities. One of its districts has been specifically dedicated to cultural infrastructures and has attracted substantial media coverage with the selection of renowned international (st)architects to design its four museums and art centre.

The emphasis put on this project is relevant insofar as it shows the emirate's will to be "put on the map" when referring to such themes as culture and education. Drawing internationally famous institutions such as Le Louvre for a museum (and thus an education facility) on Saadiyat Island or the Massachusetts Institute of Technology MIT as partner in the Masdar Institute of Science and Technology MIST (and thus an education facility too) is therefore a means to achieve legitimacy in its projects. These are not only symbols of change but also reflect a political drive to affect the economic structure of the emirate in a strive to enhance its durability by diversifying and investing into education as well as culture, tourism and leisure.

4 Conclusion

As of the present day, Masdar City consists solely of the scientific institute. Due to the ongoing financial crisis, development projects in the U.A.E. have been considerably diminished in scale and those actually being implemented have suffered severe delay. The MIST for example, only opened in September 2010, almost a year after expected delivery.

So what is Masdar City really about – both in its concept and its current reality? It is undoubtedly a real-estate project of a private state-owned enterprise which is managed as such, and thus is still expecting to meet its production targets. Part of the project management comprises marketing machinery and its inherent rules that heavily sell Masdar City as a unique model of a CO_2 free city – most probably just in order to correspond to a global demand. Its specific local context is acknowledged, yet minimised to a still recognisable extent.

The entire endeavour seems to root in a genuine intention to change and diversify the economic structure of the Emirate of Abu Dhabi, progressively moving it away from oil and gradually "sustainabilising" it in a knowledge-based economy on the one hand and renewable energies on the other. The latter is also a means to eventually satisfy the region's energy needs, with the progressive depletion of oil reserves on the long run and the necessary change involved as it is likely that solar power produced in Masdar City would be fed into the local energy network. The connection to the local power grid however also got delayed and was delivered almost a year later than expected.

Sustainability, in the context of Masdar City on the one hand and of the Emirate of Abu Dhabi on the other, is defined in a mixed way where the environmental and the economical aspects are separately defined and given varying importance. Here, sustainability is very much understood as the durability of economic activities in a given historical and socio-cultural environment to be preserved.

Fences on Saadiyat Island

Photos: T. Marshall/A. Müller 2011

Another key element in the current transformation of Abu Dhabi is its intention to become "leader" (being the best in fellow emirate countries) in all topics to be taken on board of this transformation process. This too is sort of durability as it would guarantee a visibility through international recognition. In the case of Masdar City, the aspiration was to deliver one of the most sustainable cities in the world – but this has so far only been achieved to a limited extent when taking into account its particular desert environment, technical reliance and current financial turmoil.

Annotations

(1)
This is not be mixed up with the The Berlage Institute PhD Programme 'The City as a Project'. (cf. http://thecityasaproject.org). For the Masdar City project see www.masdar.ae.

(2)
"Mubadala Development Company PJSC (Mubadala) was established in October 2002 as a Public Joint Stock Company and is a wholly owned investment vehicle of the Government of Abu Dhabi, in the United Arab Emirates. Mubadala's mandate is to facilitate the diversification of Abu Dhabi's economy. Its focus is on managing long-term, capital-intensive investments that deliver strong financial returns and tangible social benefits for the Emirate. The company pursues opportunities with the potential to deliver strong social returns for Abu Dhabi as well as generating a commercial profit." (http://en.wikipedia,org/wiki/Mubadala_Development_Company; see also http://mubadala.ae/about/history)

(3)
Four of the other set of pillars are Masdar Institute, Masdar Capital, Masdar Power and Masdar Carbon, each set up to respond to a specific market. "Investment in these markets is made via two funds: the Masdar Clean Technology Fund (MCTF), launched in 2006, and the DB Masdar Clean Tech Fund (DBMCTF), launched in 2009. MCTF, a fully deployed US$ 250 million fund invested US$ 45 million in three cleantech funds and the remaining US$205 million in 12 direct investments in companies, as lead- or co-lead investor. It was launched in conjunction with partners Consensus Business Group, Credit Suisse and Siemens AG. DBMCTF, which raised US$ 265 million in its first close, has an initial investor group led by Siemens and includes the Japan Bank for International Cooperation, Japan Oil Development Co. Ltd, Nippon Oil Corporation, Development Bank of Japan and GE." (Masdar City 2011: 20)

(4)
"Law No. 22 of 2007, issued by His Highness Sheikh Khalifa Bin Zayed Al Nahyan, President of the UAE, in his capacity as Ruler of the Emirate of Abu Dhabi, established Masdar and authorised it to set up Masdar City as a special economic zone in the Emirate." (Masdar City 2011: 18) Similar developments take place around the globe in general and particularly in the Middle East Region, in establishing e. g. the King Abdullah Economic City in Saudia Arabia. (cf. Ouroussof 2010b)

(5)
See for the origins of sustainability: 1560 – Forstwirtschaftlicher Nachhaltigkeitsgedanke der kursächsischen Forstordnung; 1713 – „Sylvicultura oeconomica, oder haußwirthliche Nachricht und Naturgemäßige Anweisung zur wilden Baum-Zucht" von Hans Carl von Carlowitz (Nachhaltige Nutzung von Wäldern); 1732 – Hermann Friedrich von Göchhausen; 1795 – „Anweisung zur Taxation und Beschreibung der Forstbestände" von Georg Ludwig Hartig (Nachhaltigkeit der Nutzung = Bewirtschaftungsweise eines Waldes / sustained yield wurde als Begriff ins Englische übertragen und von der internationalen Forstwirtschaft aufgegriffen); 1972 – „Grenzen des Wachstums" des Club of Rome (http://de.wikipedia.org/wiki/Nachhaltigkeit)

(6)
While visiting the city, the authors met on 13 December 2011 a group of sparsely dressed foreigners looking around.

(7)
See the marketing feature on LIVE 1 AD Sports on 13 December 2011 at 20:50 UAE time.

(8)
„In dieses Bewertungsschema können – pars pro totum – die beiden viel besprochenen klimaneutralen Stadtvisionen Masdar City (2008) und Monte Corvo Eco City (2007) eingeordnet werden. Auch in diesen Systementwürfen zeigt sich das Konstitutionsdilemma bei der Suche nach sinnstiftenden Repräsentationsformen im Sinne einer heute selbstreflexiven Überprüfung, Korrektur und Fortentwicklung. Dennoch sind diese Konzepte ein wichtiger Beitrag für die Weiterentwicklung auf der technischen Funktionsebene ökologischer Stadtkonzepte und damit auch für die Weiterentwicklung innovativer Verfahren und technischer Innovationen. Die viel besprochene Ökostadt Masdar City (Konzeptbeginn 2006) im Emirat Abu Dhabi entwickelt eine faszinierende Technik- und Bildvision zur klimaneutralen Stadt. Zusätzlich gründet Ihre ökologische Stadtidee nicht nur auf der Anwendung neuer ökologischer Standards, sondern zielt auf ein ökologisches Verantwortungsbewusstsein in Form einer Wissenschaftsstadt zur ökologischen Stadttechnikforschung. Hinter diesem Entwurfs- und Planungsoptimismus zur Implementierung einer ökologischen Stadtidee steht ein breites Bündnis aus staatlichen und wissenschaftlichen Planungskompetenzen und ihren Diskursmodellen" (Krings in this volume).

(9)
Concerning the establishment of IRENA see www.irena.org; also Scheer (2010: 247): „Wenn wir die Entstehung der IRENA mit der Genesis der 1957 gegründeten internationalen Atomenergie-Agentur vergleichen, so sind die Unterschiede ebenso augenfällig wie paradox: Die Atomenergie-Agentur wurde in kurzer Zeit aus dem Boden gestampft und konnte auf die breite und enthusiastische Unterstützung aller Regierungen und des UN-Systems sowie eine von vorneherein großzügige finanzielle Ausstattung zählen. Ihre Gründung atmete den Geist des seinerzeit als verheißungsvoll empfundenen neuen Zeitalters: des Atomzeitalters. Die IRENA hingegen musste ein halbes Jahrhundert später mühselig gegen die Widerstände etablierter internationaler Regierungsorganisationen durchgesetzt werden, auch gegen Widerstände im UN-System selbst und seitens der Weltbank – und sogar diejenige Regierung, die auf internationaler Ebene die formellen Schritte zur Gründung einleitete, musste zunächst lange zum »Jagen getragen« werden. Vom besonderem Enthusiasmus seitens der Regierungen ist wenig zu spüren, als ginge es bei den erneuerbaren Energien um eine Nebensächlichkeit – und nicht um den Eintritt ins Solarzeitalter, das allein erfüllen kann, was man sich vom Atomzeitalter allzu leichtfertig versprach. Dies zeigt, wie weit die Bekenntnisse zu erneuerbaren Energien noch von der Erkenntnis entfernt sind, dass für ihre Durchsetzung mindestens ebenso viel politische Tatkraft erforderlich ist, wie für die Atomenergie seit Jahrzehnten aufgeboten wird."

(10)
Concerning the establishment of MIST see www.masdar.ac.ae/inc/5/faculty-list.php.

(11)
The mission of 350.org is described as follows: "350.org is building a global grassroots movement to solve the climate crisis. Our online campaigns, grassroots organizing, and mass public actions are led from the bottom up by thousands of volunteer organizers in over 180 countries. 350 means climate safety. To preserve our planet, scientists tell us we must reduce the amount of CO_2 in the atmosphere from its current level of 392 parts per million to below 350 ppm (…)" (www.350.org/en/mission).

(12)
Concerning this urban project see www.saadiyat.ae.

References

Abu Dhabi Urban Planning Council (ed), no date: Plan Abu Dhabi 2030. Urban Structure Framework Plan. Abu Dhabi.

Commission of the European Communities, 2011: Energy Roadmap 2050, http://ec.europa.eu/energy/strategies/2011/roadmap_2050_en.htm (last accessed on 16 January 2012).

Krings, I., 2012: Das „Realisieren“ der klimaneutralen Stadt. Wenn Utopie und Realität kollidieren. Informationen z. Raumentwicklung, 2012, 5-6.

Le Monde, 2011: WISE. We have to invest in our youth. 3 November 2011.

Masdar City (ed), 2011a: Business Handbook. Abu Dhabi.

Masdar City (ed), 2011b: Exploring Masdar City. Abu Dhabi.

Masdar City (ed), 2011c: The Global Centre of Future Energy. Abu Dhabi.

Ouroussoff, N., 2010a: In Arabian Desert, a Sustainable City Rises. The New York Times, September 25, 2010, http://www.nytimes.com/2010/09/26/arts/design/26masdar.html (last accessed on 16 January 2012).

Ouroussof, N., 2010b: Saudi Urban Projects Are a Window to Modernity. The New York Times, December 13, 2010, http://www.nytimes.com/2010/12/13/arts/design/13desert.html (last accessed on 16 January 2012).

Qatar Foundation for Education, Science and Community Development (ed), no date: WISE – World Innovation Summit for Education, http://www.wise-qatar.org/content/about-us (last accessed on 16 January 2012).

Rauterberg, H.,2011a: Die andere Revolution. DIE ZEIT, 24. Februar 2011, Nr. 9.

Rauterberg, H., 2011b: Testlabor in der Wüste. Masdar City – das Experiment der ersten CO_2-neutralen Stadt. Baumeister, Zeitschrift für Architektur, 108/Juni 2011.

REN 21 (ed), no date: Country Profile United Arab Emirates, www.map.ren21.net/PDF/ProfilePDF.aspx?idcountry=196 (last accessed on 16 January 2012).

Sack, D.,1989: Damaskus. Entwicklung einer orientalisch-islamischen Stadt. Damaszener Forschungen 1. Mainz.

Scheer, H., 2010: Der energethische Imperativ. München.

Smith, A.; Gill, G., 2010: Nachhaltigkeit. Masdar City. Klimagerechte Planung. ARCH+, Nr. 196/197.

The Government of Abu Dhabi (ed), 2008: The Abu Dhabi Economic Vision 2030. Abu Dhabi.

The Guardian, 2011: Which nations are most responsible for climate change? www.guardian.co.uk/environment/2011/apr/21/countries-responsible-climate-change (last accessed on 6 January 2012).

UPC – The Abu Dhabi Urban Planning Council, o. J.: Abu Dhabi 2030. www.upc.gov.ae/abu-dhabi-2030.aspx?lang=en-US.

Wikipedia: http://en.wikipedia.org/wiki/Masdar_City (last accessed on 16 January 2012).

350.org (ed), no date: www.350.org/en (last accessed on 16 January 2012).